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(54) TRANSPORTATION SYSTEM

(71) I, PIERRE MARC BOURASSA, a Canadian citizen of 7415 Malo Street, Brossard, Province of Quebec, Canada, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a passenger and/or cargo transportation system.

The known mass and cargo transportation systems are relatively complex, require drivers or train crews and/or are relatively expensive to operate. As a result a large proportion of the public prefers to use automobiles for urban transportation.

According to the present invention we provide a transportation system comprising a main line, a station elevated relative to each one of a pair of places along said main line, a station line passing by said elevated station and extending from one to the other of said pair of places, said main line forming a by-pass section relative to said station line and joining said pair of places, a car unit having first drive means constructed and arranged to drive the car unit at a cruising speed, second drive means adapted to drive said car unit at a predetermined low speed less than said cruising speed and an overrunning clutch connected to said second drive means and adapted to allow travelling of said car unit faster than said predetermined low speed, and power supply means adtpeed to selectively energise the first and second drive means so that the first drive means only is energised along said main line and the second drive means only is energised along said station line.

A preferred embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a plan section of a station and the associated lines of travel of a transportation system according to the invention;

Figure 2 is a longitudinal section as seen along line 2—2 in Figure 1;

Figure 3 is a cross-sectional view through the station as seen along line 3—3 in Figure 2;

Figure 4 is a side view of a passenger car unit;

Figure 5 is an end view of the passenger car unit of Figure 4;

Figure 6 is a bottom view of the passenger car unit of Figures 4 and 5;

Figure 7 is a cross-sectional view as seen along line 7—7 in Figure 8 of a slow speed drive and overrunning clutch assembly of the circuit;

Figure 8 is a cross-sectional view as seen along line 8—8 in Figure 7;

Figure 9 is a diagrammatic view of a station selection circuit of the car unit operatively engaging the station destination detecting circuit of a selected station;

Figure 10 is a diagrammatic view of the station selection circuit of the car unit operatively engaging the station destination detecting circuit of a station not selected;

Figures 11, 12 and 13 are diagrammatic views of the station selection circuit of a car unit in operative engagement with a car calling circuit for three distinct conditions of operation;

Figure 14 is a diagram showing the details of a control circuit for station selection switches of the station selection circuit;

Figure 15 is a diagrammatic illustration of a door control circuit for controlling the opening and closing of the car unit doors and station doors and a car stop-go circuit for controlling the stopping and starting of the car unit at a station;

Figure 16 schematically illustrates a car spacing control system for controlling the space between consecutive car units along the main line;

Figure 17 is a schematic view of a car travel control system for controlling the movement of car units along a station line; and

Figure 18 is a plan view of a typical access and exit station according to the invention.

The car units 1 according to the inven-

tion travel at a predetermined constant speed along a main line 2, for instance on tracks 3. A plurality of stations, such as 4, are spaced along the main line 2 and are elevated relative to the latter, for instance to overlie the same. A station line joins each station to the main line at a pair of places spaced along the latter on opposite sides of the corresponding station. Each station line includes for each of the two opposite directions of travel at the station, a pair of inclines 5 and 6 arranged on opposite sides of the station between the above-mentioned places for access of the car units 1 from the main line 2 to the station 4 and for departure from the latter back to the main line. The vertical distance between the main line 2 and the station line at the station is such that a major portion of the kinetic energy of the car units is converted into potential energy when the car units move from the main line to the station.

A car switching mechanism of any suitable and known type, not shown, is positioned at the merging point between the incline 5 and the main line 2 and is arranged to deviate the car units 1 through the corresponding station line, when desired and upon actuation of station selection circuits provided to that effect in each car unit.

The car unit 1, adapted for use with the traffic lines of Figures 1, 2 and 3, is illustrated in Figures 4, 5 and 6 and includes a body having a side door 16, seats 17, drive train compartments 18 and a control panel 19 with push buttons 20 for station selection by the passengers and, lights 21 to confirm each station selection. The body is mounted on a pair of rotatable axles 11 each provided with a pair of fixed wheels 9 adapted to run on the tracks 3. As shown in the drawings, each axle 11 is driven and forms part of a separate drive train. Obviously, only one axle 11 could be driven or both could be driven by the same motor means.

Each axle is provided with a relatively high speed or cruising speed drive which includes a motor 12 drivingly connected to the axle 11 through a reduction gear box 13, of any suitable type, as are known in the art, and a relatively low speed drive which includes a motor 14 drivingly connected to the axle 11 through a speed reduction gear and an overrunning clutch 15. The low speed drive is shown in more detail in Figures 7 and 8.

Referring to Figures 7 and 8 the speed reduction gear comprises a worm gear 41 mounted on a sleeve 43 for free rotation relative to the wheel axle 11 and a worm 44 carried by a shaft 45 which is driven by the motor 14. If necessary, a fluid drive can be interposed between motor 14 and worm 44 and also between motor 12 and reduction gear box 13. The overrunning clutch 15 comprises an inner rotor 42 fixed to the worm gear 41 and a generally cup-shaped member 46 fixed to the axle 11 and embracing the inner rotor 42. A casing 15*a* houses the reduction gear and clutch 15.

The member 46 is formed with a number of axially extending recesses spaced at uniform intervals around the inner surface of the member 46. The depth of each recess varies uniformly from one side to the other to form a camming surface. A roller 47 is mounted in each recess and is biassed by a spring 48 towards the narrower side of the recess to engage the camming surface and the rotor 42.

Operation of the clutch is as follows, assuming the car unit moves forward, when the axle 11 and hence the member 46 is rotating in the anti-clockwise direction as shown in Figure 7 and the rotor 42 is driven by the motor 14 in the anti-clockwise direction, then if the member 46 is rotating in the anti-direction direction at a faster speed than the rotor 42, the rollers 47 move towards the wider side of the recesses, against the action of the associated springs 48, thereby allowing free running of the member 46 and hence the axle 11. However, if the member 46 is rotating in the anti-clockwise direction at a slower speed than the rotor 42, the rollers 47, aided by the action of the associated springs 48, move towards the narrower side of the recesses thereby locking the member 46 to the rotor 42 so that the axle 11 is driven by the motor 14.

In operation the cruising speed motors 12, which can be of the induction, synchronous or other constant speed type, drive the car unit along the main line at a constant and predetermined speed. When a car unit 1 starts up the incline 5 to a station, the current to the cruising speed motors is cut-off in any appropriate manner, such as by discontinued bus bars or wires allowing the car to coast under its own momentum. The initial coasting speed should normally be sufficient for the car to reach the station 4 without assistance from the low speed motors 14. However, the low speed motors 14 are energised throughout the climb along the incline and should abnormal friction or insufficient cruising speed prevent the car unit from reaching the station under its own momentum, it is then driven by the low speed motors 14 through engagement of the overrunning clutch 15. The latter allows the car to travel or run at higher speeds than when driven by the low speed motors, for instance when driven by the cruising speed motors 12 or under its own momentum. Thus if the low speed motors are set for a speed of three miles per hour, the car unit will always be free to run forward at a greater speed, but will be driven at the 3

m.p.h. speed whenever their coasting speed tends to drop below that. The low speed motors are also used to start the car unit from station 4 down the incline 6 to the main line and are cut off anywhere along the downward ramp. The cruising speed motors are re-energised when the car re-enters the main line. The above-mentioned fluid drive allows for smooth starting despite the use of a single speed motor. Coasting of the car unit 1 is therefore obtained either by discontinuing the driving of the car unit by the high speed motors 12 or by the disengagement of the low speed motors 14 when the car unit, moving down the incline 6, attains a speed in excess of the minimum speed of the low speed motors.

A station selection circuit is mounted onto each car unit 1 and is shown in simplified form in Figures 9 to 13 inclusive. The circuit shown includes station selection switches 49*a* to 49*e*, each one corresponding to a particular station 4. For practical reasons, only five station selection switches are illustrated but, obviously, any number of stations and switches may be used. One pole of each station selection switch 49*a* to 49*e* is connected to a respective sliding contact 51*a* to 51*e* respectively, the other poles of the selection switches are all connected to a common sliding contact 50. The sliding contacts 50 and 51*a* to 51*e* project outwardly of the corresponding car unit 1 and are arranged to engage matching fixed contacts secured along the main line, as will be explained hereinafter.

Each station selection switch 49*a* to 49*e* has a control circuit, as shown in Figure 14, comprising a power supply, illustrated as a battery 52, connected in series with a normally closed cancellation switch 54, an actuating coil 53, the corresponding station selection push button 20 and the corresponding station selection indicating light 21. The circuit further includes a selection holding switch 55 connected in parallel with the corresponding station selection push button 20. An actuating cell 56 and spring 57 are operatively connected to the cancellation switch 54. A pair of sliding contacts 58, 59 are provided on the car unit 1 and connected in series with the coill 56. The spring 57 is arranged to keep the switch 54 closed when the coil 56 is not energised. The coil 53 and a spring 60 are operatively connected both to the switch 55 and the corresponding switch 49*a* to 49*e* and the spring 60 is arranged to keep the switch 55 open when the coil 53 is not energised.

When a selected push button 20 is pressed, the current from the power supply 52 flows through the normally closed switch 54, the actuating coil 53, the temporarily closed push button 20 and the indicator light 21. The current through the actuating coil 53 closes the switch 55 and the switch 49*a* to 49*e* which corresponds to the selected station 4. When the switch 55 is closed, which happens almost instantaneously with closing of the corresponding push button 20, current can continue to flow through the actuating coil 53, even if switch 20 is opened. Therefore, the corresponding station selection switch 49*a* to 49*e* remains closed until the cancellation switch 54 is caused to open. This happens when sliding contacts 58 and 59 enter into sliding contact with wires or rods, not shown, located for a given station at any point past the car switching mechanism along the station line leading to that station. Preferably, the above-mentioned wires or rods for the sliding contacts 58 and 59 are positioned at the station or just after. The cancelling wires or rods may also be grouped at the end of the main line 2. The sliding contact with the appropriately energised cancellation wires or rods causes energisation of the actuating coil 56, opening of the switch 54 against the spring 57, de-energisation of the actuating coil 53 and opening of the corresponding switches 55 and 49*a* to 49*e* by the spring 60.

Prior to each station line, there is provided a station destination detecting circuit including an appropriate pair of wires, rods and contacts, such as 61 and 62*a* for station *a*, 61 and 62*b* for station *b* and so on. Each station destination detecting circuit is connected by leads or conductors 63 and 64 to the corresponding car switching mechanism to divert the car unit concerned along the station line of the selected station.

As illustrated in Figure 9, a car unit having switches 49*a* and 49*c* closed, for stopping at stations *a* and *c*, approaches the station line of the station *a* and there results establishment of a circuit between the leads 63 and 64 through the sliding contacts 51*a* and 50 and the station selection switch 49*a*. As a result, the corresponding car switching mechanism is actuated to cause diversion of that car unit from the main line 2 through the station line of station *a*.

As illustrated in Figure 10, the same car unit with the same selection of stations *a* and *c* approaches the station *b*. Since the station selection switch 49*b* is open, there is no circuit established through the leads 63 and 64, the car switching mechanism is not energised and the car unit by-passes the station *b* along the main line 2.

Each station is also provided with a car calling circuit adapted to call to that station an empty car unit 1, or more precisely, a car having no selection made. Each car calling circuit includes a set of fixed terminals, contacts, wires or rods 65, 66 equal in number to the sliding contacts 49*a* to 49*e* and 50 and arranged to register with the latter ahead of the corresponding station

line and car switching mechanism. An actuating coil 67 is connected to an energising circuit through the contacts 65, 66 and is normally not energised. The coil 67 and a spring 69 are operatively connected to a switch 68 which is normally closed by the spring 69 and opened when the coil 67 is energised. The switch 68 is connected in series with a car calling switch 70 accessible to the passengers to call an empty car unit to the calling station. The car calling switch 70 and the switch 68 are connected to the corresponding car switching mechanism to actuate the latter when both switches are in the closed position.

Looking at Figure 11, with the sliding contacts $51a$ to $51e$ and 50 engaging the wires, rods or contacts 65 and 66, since passengers inside the car unit have chosen to stop at two stations, the car is not empty, the circuit to the actuating coil 67 is closed and the latter is energised and opens the switch 68 such that, even if a car unit is called by closing the switch 70, no current flows to actuate the car switching mechanism of the approaching car unit. The latter therefore bypasses that station, unless the latter corresponds to a station selected for a stop, such as stations *a* and *c*.

Looking at Figure 12, all the station selection switches $49a$ to $49e$ remain open and presumably the corresponding car unit is empty. The energising circuit is therefore not activated by one of these selection switches, the actuating coil 67 is not energised and switch 68 remains closed by the spring 69. Since switch 70 has been closed to call an empty car unit to that station, the car switching mechanism is energised and the approaching car is diverted to the calling station where it automatically stops, as will be explained later, to pick up passengers.

As shown in Figure 13, although all the switches $49a$ to $49e$ are open and a car unit is available to be called to a station, the car unit is not diverted, since the switch 70 is open and the car switching mechanism is not energised.

In order to ensure proper spacing of the car units 1 at all times and to prevent collisions, particularly when a car unit which has stopped at a station is routed back to the main line, the transportation system according to the invention is preferably provided with a car spacing control system for the main line as illustrated in Figure 16 and an individual car travel control system for each station line as illustrated in Figure 17.

Referring to Figure 16, the tracks 3 are sub-divided into track sections 134 separated by suitable insulators $134a$. The track sections form two rows of track sections in which the individual track sections of each row are aligned end to end and arranged such that the track sections 134 of one row are co-extensive with similar track sections of the other row, thereby forming pairs of co-extensive track sections. The two track sections of each such pair are connected to the opposite poles respectively of a power supply represented schematically by a battery 135. Separate conductor sections 136 form two rows of conductor sections extending lengthwise of the main line in which the individual conductor sections of each row are aligned end to end and arranged such that the conductor sections of one row are co-extensive with the conductor sections 136 of the other row thereby forming pairs of co-extensive conductor sections. Each pair of conductor sections is co-extensive with an adjacent pair of track sections. A pair of leads or conductors 137 connect the two track sections 134 of any of the above-mentioned pairs of track sections to the two conductor sections 136 respectively of the pair of preceding conductor sections. It therefore results that each pair of co-extensive conductor sections form an open circuit with the pair of track sections immediately ahead thereof and the power supply 135 for the latter when the pair of track sections are not otherwise electrically connected.

Each car unit includes a braking system of any appropriate type and electromagnetic switch means for controlling the energisation of the braking system and the motors. As shown in Figure 16 braking system 93 and motors 12 are connected to sliding contacts mounted on the car and arranged to engage feed lines 94 extending lengthwise of the main line. Switches 90 and 91 control the energisation of the braking system 93 and the motors 12 respectively. A spring 92 biasses switches 90 and 91 to their closed and open positions respectively and an electromagnetic coil 89 is operative when energised to move switches 90 and 91 against the biassing of spring 92 to their open and closed positions respectively. The car unit is provided with sliding contacts 85 and 86 connected in series with the actuating coil 89 and arranged to engage the pair of conductor sections which are electrically connected to the pair of track sections immediately ahead of the pair of track sections engaged by the car unit 1.

When the car unit 1 is travelling along the main line coil 89 remains energised so long as contacts 85 and 86 engage a pair of conductor sections across which there is a potential difference thereby keeping switch 90 open and switch 91 closed so that the braking system is de-energised the motors 12 energised.

When, however, a car unit 1 is present on the pair of track sections immediately

ahead of the car unit concerned, the wheels 9 and axle 11 of the car unit ahead causes the potential difference between the associated pair of conductor sections to disappear. Contacts 85 and 86 of the car unit concerned then engage a pair of conductor sections across which there is no potential difference. The actuating coil 89 is de-energised and the spring 92 then closes the switch 90 and opens the switch 91. The braking system 93 is energised and the motors 12 de-energised. As soon as the car unit leaves the pair of track sections immediately ahead of the car unit concerned, the potential difference in the pair of associated conductor sections alongside the car unit concerned is re-established, the motor 12 is re-energised and the braking system 93 is de-energised. As a result, the car unit concerned resumes forward travel.

The system of Figure 16 may be modified to use wires or rods, instead of the tracks 3 as busbars and a dual sliding contact as a jumper instead of the wheels 9 and the axle 11. Also, one row of conductor sections may be replaced by a common ground.

Contacts 85 and 86, actuating coil 89, switches 90, 91 and spring 92 form electromagnetic switch means for controlling the energisation of the braking system 93 and motors 12 when the car unit is travelling along the main line. The electromagnetic switch means may be modified or similar switch means provided for controlling the energisation of the motors 14 and braking system when the car unit enters a station line. In the following description of the station line systems the electromagnetic switch means has been modified in any appropriate manner so that when coil 89 is energised the motors 14 are energised and the braking system 93 de-energised and vice versa.

Referring to Figure 17, the station line comprises access zone C, station stopping zone D and station departure zone E. The access zone C comprises track sections 138 arranged in pairs of co-extensive track sections connected to individual power supplies, not shown, and conductor sections 139 extending lengthwise of the access zone and arranged in pairs of co-extensive conductor sections. As for the main line each pair of conductor sections is co-extensive with an adjacent pair of track sections and each pair of track sections is electrically connected to the pair of preceding conductor sections.

The length of the track and conductor sections depends on the desired spacing of the cars, taking into consideration the speed and braking distance of the car units 1 and the loading and unloading limitations at the stations. Preferably, along the main line 2, all the track and conductor sections 134 and 136 are of equal lengths. For example, such length may be 220 feet for a cruising speed of 30 m.p.h. and a 5-second interval between car units. Along the access zone C, however, different lengths of track and conductor sections 138 and 139 may be introduced, such that for instance, as the car units go up the incline 5, their speed and their spacings are gradually reduced in proportion to the distance from the station stopping zone D.

The station stopping zone D includes a pair of conductor sections 87 extending coextensive of each other and connected to a car stop-go control circuit for controlling the stop-and-start action of the car unit at the station. The car stop-go control circuit includes a battery 133 and a stop-go switch 88, operatively connected to an actuating coil 131 and a spring 132. Normally the actuating coil is not energised and the switch 88 is held open by the spring 132 so there is no potential difference between the conductor sections 87. When the car unit enters the stopping zone D the contacts 85, 86 engage the conductor sections 87 and since there is no potential difference between the conductor sections 87 the actuating coil 89 is de-energised causing the braking system 93 to be energised and the motors 14 to be de-energised.

When the car unit 1 stops at the station 4, terminals or sliding contacts 71 to 77 inclusive projecting outwardly of the car body engage with corresponding contacts 78 to 84 projecting from the tunnel or station walls, floor or ceiling, in any convenient location to operate a door control circuit which is adapted to open and close the car and station doors and control the car stop-go circuit. The door control circuit is shown in more detail in Figure 15. The contacts 78 to 84 are of appropriate extension lengthwise of the station line to provide the necessary tolerance as to the actual place where the car units stop.

Referring to Figure 15 the contacts 78 and 81 are connected by conductors 95 and 96 to any suitable power supply and when engaged by the contacts 71 and 74 on the car unit a time delay circuit 97 is energised by a circuit through a junction box 98 and conductors 99, 100, and 101 connecting the sliding contacts 71 and 74 one to the other. The time delay 97 momentarily delays the current from flowing to a conductor 102 for a certain time, say 3 seconds. During the same time delay, the current is allowed to circulate through a conductor 103 until the time delay has elapsed. When the conductor 103 is energised, the current flows from the time delay 97, through a normally open limit switch 104 which is then temporarily closed until the car door

is subsequently opened, and through an actuating coil 105 which moves a bar 117 downwards, causing opening of a switch 106 and closing of a switch 107.

Once the switch 107 is closed, current flows from the junction box 98 through the conductor 108, normally closed limit switch 109 and the switch 107 to a junction box 110 and a motor 111 which causes opening of the car doors 16. From junction box 110, current also circulates through a conductor 112, contacts 72 and 79 and conductor 113 to a motor 114 which opens the station doors, not shown.

When the car door is fully opened, it actuates limit switches 109 and 115, so that normally closed switch 109 opens, stopping the current to the motors 111 and 114. The normally opened switch 115 closes, feeding current to an actuating coil 116 which moves the bar 117 upwards, causing opening of the switch 107 and closing of the switch 106. A plunger 119 is resiliently biassed by a spring 120 into engagement with a notched portion 118 of the bar 117 so as to hold the bar in either of its extreme positions, that is switch 106 open, switch 107 closed and switch 106 closed, switch 107 open. The resilient biassing is not sufficient to prevent movement of the bar upon actuation of coil 105 or coil 116.

When the delay of the time delay 97 has elapsed, current is allowed to flow from the junction box 98, through conductor 99, time delay switch 97, conductor 102, normally closed limit switch 121, conductor 122 and switch 106. However, either one station selection switch 49*a* to 49*e* or a switch 123 has to be closed for current to flow to motors 111 and 114 through the conductor 124 and to thereby close the station and car doors by reverse operation of these motors. Switches 49*a* to 49*e* symbolise the station selection switches of Figures 9 to 14 inclusive and actuated by the corresponding push buttons 20. The switch 123 may be closed by an actuating coil 125, which becomes energised through the contacts 76, 83, 77, and 84 when another car unit is coming up the incline 5 of that station.

As a result of the switches 49*a* to 49*e* and 123 in series with the conductor 124, if none of the push buttons 20 has been pressed, as when there is no passenger in that car unit, the doors remain open and the car unit stands by at the station until either one push button 20 is pressed or another car comes up the incline 5 to that station. In the latter event, the actuating coil 125 is energised and closes the switch 123. Either way current flows to the motors 111 and 114 and the car doors close.

If the car door meets an obstacle to closing, the leading edge thereof closes the normally open limit switch 126. This energises the actuating coil 105 which reverses the switches 106 and 107, so that the motor 111 is energised from the junction box 110 instead of by conductor 127 and opens the car door 16 instead of closing it. When the door 16 reaches the fully open position, it actuates limit switch 115 which, as seen above, reverses the switches 106 and 107 and causes the motor 111 to close the door.

The passengers may also press a button, not shown, closing a switch 128 and energisinf the actuating coil 105, producing the opening of the car door 16 as by an obstacle actuating the limit switch 126.

When the car door 16 is fully closed, it actuates the limit switches 104, 121, and 129. Assuming that the set delay of the time delay 97 has elapsed, there will no longer be current flowing through the conductor 103, so the fact that the normally open limit switch 104 will be closed is not significant. The switch 121 opens and stops the motor 111. The conductor 102 is live and feeds current through a conductor 130 and contacts 75 and 82 to the actuating coil 131 of the car stop-go circuit, which then closes the switch 88 against the action of spring 132. This causes a potential difference between the conductor sections 87, thereby energising the actuating coil 89 causing the braking system 93 to be de-energised and the low speed motors 14 to be energised so that the car moves on to the next conductor sections, as will be described later.

It is to be noted that a car unit 1 can only move away from a station with the car doors fully closed, since otherwise the limit switch 129 does not produce closing of the switch 88 and energisation of the coil 89 and the motors 14. The closing of switch 123 does not interfere with the switches 126 and 128 to re-open the car door, if necessary, nor with the time delay 97 which should leave sufficient time for the passengers to get off, or at least to reach the button 128 or the leading edge of the door so that it can be kept open longer if required.

The departure zone E includes two short conductor sections 87*a* interposed between the conductor sections 87 and the next pair of conductor sections in zone E. The conductor sections 87*a* are electrically connected connected to the first pair of track sections in zone E and are energised by the power supply (not shown) connected thereto. Thus a car unit leaving the conductor sections 87 advances to the conductor sections 87*a* and only advances to the next pair of conductor sections if the first pair of track sections is clear. The conductor sections 87*a* therefore act as a control to ensure the car unit

is subjected to the correct car spacing along the station line.

The departure zone E further includes a departure control circuit comprising a power supply represented by a battery 140, a pair of conductors 141 and 142 joining conductor sections 143 to the car spacing circuit along zone B or by-pass zone or portion of the main line 2 between said pair of previously mentioned places. The conductors 141 and 142 are connected in series with a pair of switches 144 and 145, which are controlled by actuating coils 146 and 147 and springs 148 and 149, respectively. The actuating coils 146 and 147 are connected across the track sections 134 of the two pairs of track sections in zone B. If there is no car unit running over either pair of track sections in zone B there is a potential difference between each of the two pairs of conductor sections and the actuating coils 146 and 147 are energised thereby closing both switches 144 and 145. A potential difference appears between the conductor sections 143 so that upon engagement by the contacts 85 and 86 of the car unit 1, the actuating coil 89 remains energised, keeping the motors 14 energised, causing the departure of the car unit down the incline 6 and the entry thereof into the main line. This is accomplished without danger of collision or inadequate spacing with cars already on the main line 2, since zone B is sufficiently long to allow a departing car unit to insert itself into the main line before the arrival of a car unit by-passing the same station.

The presence of a car unit on the one or the other of the pair of track sections along zone B causes the potential difference between the associated pair of conductor sections to disappear. As a result the corresponding switch 146 or 147 opens under the action of its associated spring 148 or 149 and the conductor sections 143 are not energised so that upon engagement by the contacts 85, 86 of a car unit the actuating coil 89 is de-energised causing the braking system 93 to be energised and the car unit to hold its departure until both switches are closed.

When the car unit travels down the incline 6, the contacts 85, 86 thereof engage the conductor sections 150 which are maintained energised by a suitable power supply, such as a battery 151, thereby keeping the coil 89 energised and the motors 14 energised. The car unit therefore maintains an uninterrupted course down the incline 6, the overrunning clutch 15 allowing the wheel axle 11 to disengage the drive from the motors 14 as the car unit picks up speed down the incline until the car enters into the main line, as above mentioned, where the contacts 85, 86 engage the conductor sections 136 keeping the coil 89 energised and the cruising speed motors 12 are re-energised through feed lines 94. The current to the low speed motors 14 is cut off at a suitable point down the incline 6. Once in the main line the car becomes subjected to the car spacing system of the main line. Once a car unit has left the track sections 152 of zone E, a following car unit is then allowed to proceed to the conductor sections 143 due to re-appearance of a potential difference between the track sections 152 and the conductor sections 139 connected thereto.

It will be readily understood that each set of co-extensive or laterally adjacent track sections 134 or 138 and conductor sections 136 or 139 respectively forms a car unit spacing section.

A typical station, as illustrated in Figure 18, allows two car units 1 to stop on opposite sides of the station 4 resting either on track sections 138 laid on the ground or suspended from an overhead track 7. Turnstile 153, of appropriate construction to be operated by tokens, coins or tickets, controls the access of the passengers to the station platform 154 while the turnstile 155 allows exit of the passengers.

WHAT I CLAIM IS:—

1. A transportation system comprising a main line, a station elevated relative to each one of a pair of places along said main line, a station line passing by said elevated station and extending from one to the other of said pair of places, said main line forming a by-pass section relative to said station line and joining said pair of places, a car unit having first drive means constructed and arranged to drive the car unit at a cruising speed, second drive means adapted to drive said car unit at a predetermined low speed less than said cruising speed and an overrunning clutch connected to said second drive means and adapted to allow travelling of said car unit faster than said predetermined low speed, and power supply means adtpeed to selectively energise the first and second drive means so that the first drive means only is energised along said main line and the second drive means only is energised along said station line.

2. A transportation system as claimed in claim 1, wherein each of said drive means includes a respective motor and respective contact means mounted onto the car unit and engageable with the power supply means so as to respond to arrival to and departure from said station line to selectively energise the motors of said first and second drive means.

3. A transportation system as claimed in claim 1 or claim 2 arranged for automatic operation and further including a plu-

rality of such stations, each station having a respective station line and a respective station destination detecting circuit, the car unit including a station selection circuit for selecting stations, the station selection circuit having car contact means mounted on the car unit, each station destination detecting circuit having respective fixed contact means mounted along the main line prior to the station line of the associated station, each fixed contact means being engageable with the car contact means and each station destination detecting circuit being arranged to control automatically the movement of the car unit so that if the associated station is selected the car unit is diverted into the station line of the associated station.

4. A transportation system as claimed in claim 3 wherein each station destination detecting circuit is connected to a respective car switching mechanism positioned along the main line after the associated uxed contact means and prior to the station line of the associated station and each car switching mechanism is operable to divert the car unit into the station line of the associated station upon actuating of the associated station destination detecting circuit.

5. A transporation system as claimed in claim 4 wherein the station selection circuit includes a plurality of selection switches each associated with a respective one of said stations, said car contact means comprises a plurality of car sliding contacts, each car sliding contact of a group of said car sliding contacts being associated with a respective one of said selection switches and being connected to one pole of the associated selection switch, the other poles of said selection switches all being connected to a common other one of said car sliding contacts, each fixed contact means is engageable with said common car sliding contact and with the car sliding contact of the selection switch corresponding to the associated station and each station destination detecting circuit is actuated to operate the associated car switching mechanism to divert the car unit into the station line of the associated station when the selection switch corresponding to the associated station is closed.

6. A transportation system as claimed in any one of claims 3 to 5 wherein each station has a respective car calling circuit, each car calling circuit having respective fixed terminal means mounted along the main line prior to the station line of the associated station, each fixed terminal means is engageable with the car contact means and each car calling circuit is arranged to control automatically the movement of the car unit so that if no station is selected and the car calling circuit is actuated the car unit is diverted into the station line of the associated station.

7. A transportation system as claimed in claim 6 and claim 4 wherein each car calling circuit is connected to the car switching mechanism of the associated station, each car switching mechanism being positioned along the main line after the associated fixed terminal means, and each car switching mechanism is operable to divert the car unit into the station line of the associated station upon actuation of the associated car calling circuit if no station is selected.

8. A transportation system as claimed in claim 7 and claim 5 wherein each fixed terminal means comprises a plurality of terminals corresponding to said plurality of car sliding contacts, each fixed terminal being engageable with a respective one of said car sliding contacts and each car switching mechanism is operable to divert the car unit into the station line of the associated station upon actuation of the associated car calling circuit when the selection switches corresponding to all the stations are open.

9. A transportation system as claimed in any one of claims 3 to 8, including a plurality of such car units and a car spacing control system along said main line including a first row of individual conductor sections aligned end to end and extending lengthwise of said main line, individual power supply means electrically biasing each one of said individual conductor sections relative to an electrical ground, a second row of individual conductor sections aligned end to end and extending lengthwise of said main line, each one of said individual conductor sections of said second row extending co-extensive with a corresponding one of the conductor sections of said first row and forming a main line car spacing section therewith, electrical conductor means joining each individual conductor section of said first row to the individual conductor section of said second row in the preceding main line car spacing section to similarly bias each individual conductor section of said first row and the associated conductor section of said second row in the preceding car spacing section relative to said electrical ground, each car unit having respective short-circuiting means mounted thereon each short-circuiting means being arranged to engage and ground the adjacent conductor section of said second row, each car unit further including a respective electrically controlled braking system mounted thereon and a respective switch means mounted thereon and operable in response to the electrical bias of the adjacent conductor section of said second row to control the operation of the associated braking system and first drive means respectively.

10. A transportation system as claimed in claim 9, wherein said switch means in-

cludes a respective spring, electromagnetic coil and coil conductor connecting said coil to an electrical ground and engageable with the adjacent conductor section of said second row, the spring and coil being operable in response to the electrical bias of said adjacent conductor section to control the operation of the associated braking system and first drive means respectively.

11. A transportation system as claimed in claim 9 or claim 10, wherein each station line comprises an access zone, a station stopping zone and a departure zone and each station line includes a respective car travel control system comprising one row of individual conductor sections aligned end to end and extending lengthwise of the associated access zone, individual power supply means electrically biasing each one of said individual conductor sections relative to an electrical ground, another row of individual conductor sections aligned end to end and extending lengthwise of the associated access zone, each one of said individual conductor sections of said another row extending coextensive with a corresponding one of the conductor sections of said one row and forming a station line car spacing section therewith, the station line car spacing sections progressively decreasing in length in proportion to their distance from the station stopping zone, electrical conductors joining each individual conductor section of said one row to the individual conductor section of said other row in the preceding station line car spacing section to similarly bias each individual conductor section of said one row and the associated conductor section of said other row in the preceding station line car spacing section relative to said electrical ground, said switch means being operable in response to the electrical bias of the adjacent conductor section of said other row to control the operation of the associated braking system and second drive means respectively, the car travel control system further including a car stop-go control circuit at said station stopping zone and arranged to be engaged by said switch means to control the operation of the associated braking system and second drive means respectively, and a car departure control circuit electrically connected to the associated main line by-pass section and arranged to be engaged by said switch means to control the operation of the associated braking system and second drive means respectively and the departure of the car unit from the associated station line.

12. A transportation system as claimed in claim 11, wherein each car stop-go control circuit includes respective conductor means engageable with said switch means, power supply means electrically biasing said conductor means relative to an electrical ground and stop-go switch means for controlling said electrical bias, the switch means being operable in response to said electrical bias to control the operation of the associated braking system and second drive means respectively.

13. A transportation system as claimed in claim 12, wherein each car unit includes a respective door control circuit for controlling the opening and closing of the car unit and station doors respectively and for controlling said stop-go switch means.

14. A transportation system substantially as described with reference to the accompanying drawings.

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1476783 COMPLETE SPECIFICATION

7 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

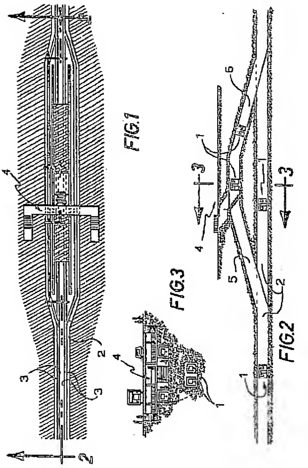

FIG.1

FIG.2

FIG.3

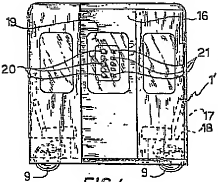

FIG.4

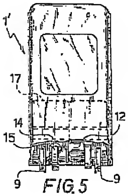

FIG.5

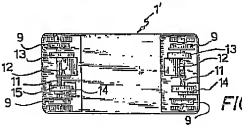

FIG. 6

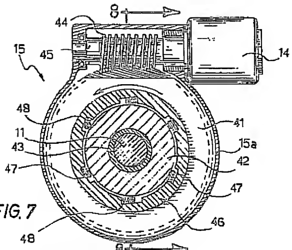
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FIG. 7

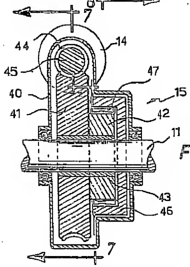
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FIG. 8

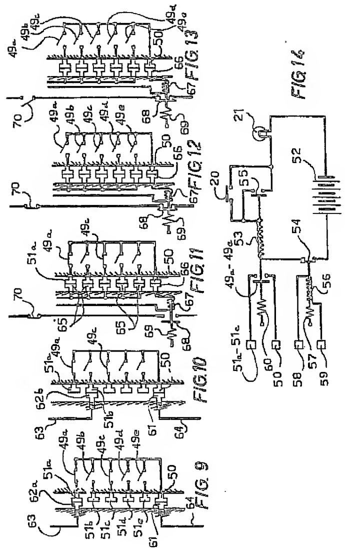

FIG 9 FIG 10 FIG 11 FIG 12 FIG 13 FIG 14

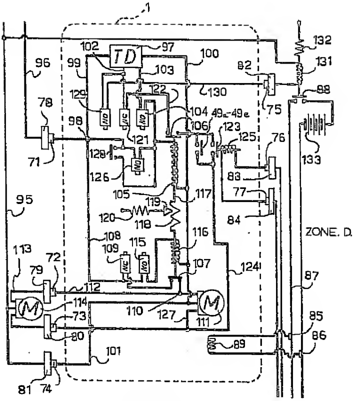

FIG. 15

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Sheet 6

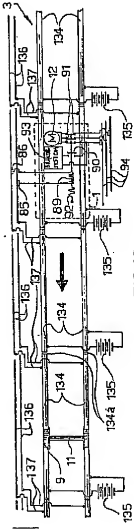

FIG.16

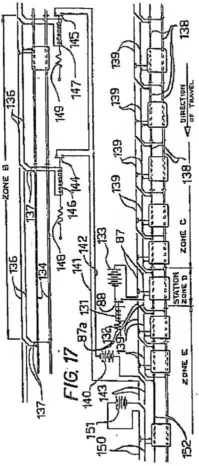

FIG.17

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Sheet 7

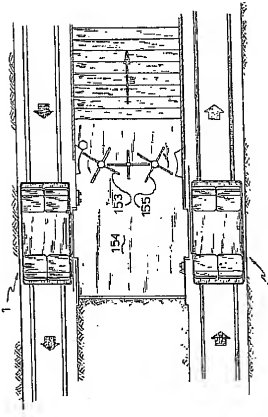

FIG.18